

### **ABSTRACT OF THE DISCLOSURE**

Nano-engineered structures are disclosed, incorporating nanowhiskers of high mobility conductivity and incorporating pn junctions. In one embodiment, a nanowhisker of a first semiconducting material has a first band gap, and an enclosure comprising at least one second material with a second band gap encloses said nanoelement along at least part of its length, the second material being doped to provide opposite conductivity type charge carriers in respective first and second regions along the length of the of the nanowhisker, whereby to create in the nanowhisker by transfer of charge carriers into the nanowhisker, corresponding first and second regions of opposite conductivity type charge carriers with a region depleted of free carriers therebetween. The doping of the enclosure material may be degenerate so as to create within the nanowhisker adjacent segments having very heavy modulation doping of opposite conductivity type analogous to the heavily doped regions of an Esaki diode. In another embodiment, a nanowhisker is surrounded by polymer material containing dopant material. A step of rapid thermal annealing causes the dopant material to diffuse into the nanowhisker. In a further embodiment, a nanowhisker has a heterojunction between two different intrinsic materials, and Fermi level pinning creates a pn junction at the interface without doping.

**[Fig. 4]**